

# QLogic 2500 Series 8Gb FC Adapters Offer Performance Benefits

## QLogic 8Gb Adapters: “The Best in Class”—8Gb Performance Exceeds the Requirements of Next Generation Data Centers

### Key Findings

The QLogic 2500 8Gb adapter product family showcases the next generation of FC SANs, with an increase in performance:

- **Performance:** 33-percent higher IOPS when upgrading to the 8Gb adapter. Tests demonstrated that in existing 4Gb infrastructure (4Gb adapter, 4Gb switch, and 4Gb storage), performance increased by over 33 percent by replacing the 4Gb adapter with an 8Gb adapter.
- **Throughput:** 100-percent higher throughput was achieved (1600MBps versus 800MBps) by using the QLogic 2500 series 8Gb adapter and QLogic 5800 8Gb switch in comparison to existing 4Gb adapter/switch configurations.



## Executive Summary

As 8Gb Fibre Channel (FC) Storage Area Networks (SANs) become a reality, IT professionals must ensure a balance within the data center infrastructure to meet the **Minimum Business Attributes**. With continued demands in the data center, it is imperative to deploy a scalable architecture to meet a full spectrum of concerns, including cost, performance, and backwards compatibility. New technologies continue to push the data center curve; server virtualization, multi-core processors, and faster server host bus architectures drive the need for increased IOPS and bandwidth requirements. The next generation 8Gb FC adapters and switches provide the evolution of increased performance to exceed the speed requirements to support the **Next Generation Data Centers**.

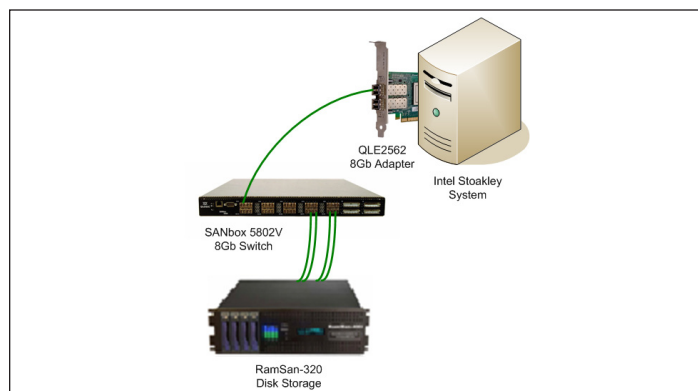
To meet the ever-growing requirements on the SAN, enterprise SAN users need to deploy a scalable adapter architecture. The QLogic

2500 series 8Gb FC adapter meets the need for the high performance required to meet the volume of data or throughput (measured in MBps) and the load of data requests (measured by IOPS). Key applications will benefit from the scalability of 8Gb FC adapters to meet an increase in server virtualization workloads, Microsoft® Exchange seats, and the high-speed requirements of Disk to Disk (D2D) backup and disaster recovery.

This white paper focuses exclusively on the raw bandwidth and IOPS performance capability of the QLogic 2500 series 8Gb FC adapter, which provides “the best in class” 8Gb performance. The QLogic 8Gb adapter provides an unprecedented level of higher performance, superior scalability, and enhanced reliability, exceeding the requirements of the next generation data centers.

## Test Setup with 8Gb

For this test, QLogic ran the latest available 8Gb adapter drivers from QLogic on an Intel® Stoakley Dual Processor(X5355) 2.66GHz – Quad Core. The system contained 4GB RAM and the Windows Server® 2003 SP1 operating system. The server was connected to an 8Gb QLogic 5802V FC switch via the QLE2562 8Gb adapter using only one port. The storage attached to the switch was a 4Gb RamSan-320 solid state disk, attached to four target ports on two Small Form factor Pluggables (SFPs). The test configuration is illustrated in the following figure.



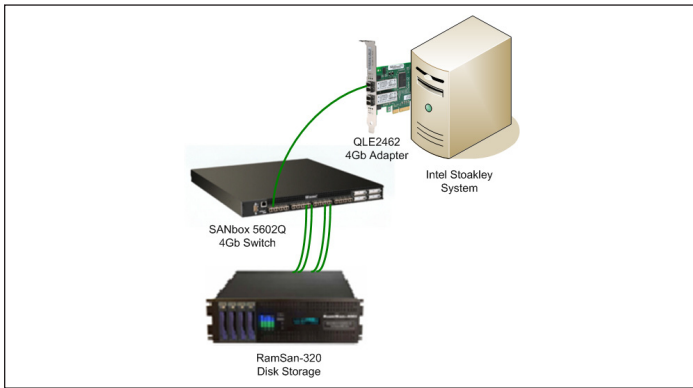
8Gb Test Setup

The tests were completed utilizing QLogic 8Gb adapters and switches. The Stoakley and RamSan solid state disk storage were commercially available; the 8Gb adapters and switches were available exclusively from QLogic at the time the test was run. All measurements were made with default settings of the adapters.

## Test Procedure

The tests were executed as per the previous *8Gb Test Setup* configuration as follows:

1. The QLogic FC adapters (PCIe) were installed with the appropriate driver on the test server.
2. Iometer from Intel measured maximum IOPS on the adapter for various block sizes, from 0.5KB to 1024KB. Tests were conducted for the following environments:
  - Sequential Writes
  - Sequential Reads
  - Sequential Read/Writes (used in this report)
3. Steps 1 and 2 were repeated with QLogic 4Gb (QLE2462) PCIe adapters and a QLogic 4Gb switch. The server and storage remained the same, but the storage network was changed. The tests were performed per the *4Gb Test Setup*, as shown in the following figure.
4. The results were compared and the performance was calculated based on the test reports.



4Gb Test Setup

### Test Results

The test results demonstrated the performance increase of the 8Gb adapter infrastructure over the 4Gb adapter infrastructure. The graphs in the following paragraphs identify and compare performance while executing sequential reads and write operations, which provided maximum IOPS and throughput measured in the following configurations:

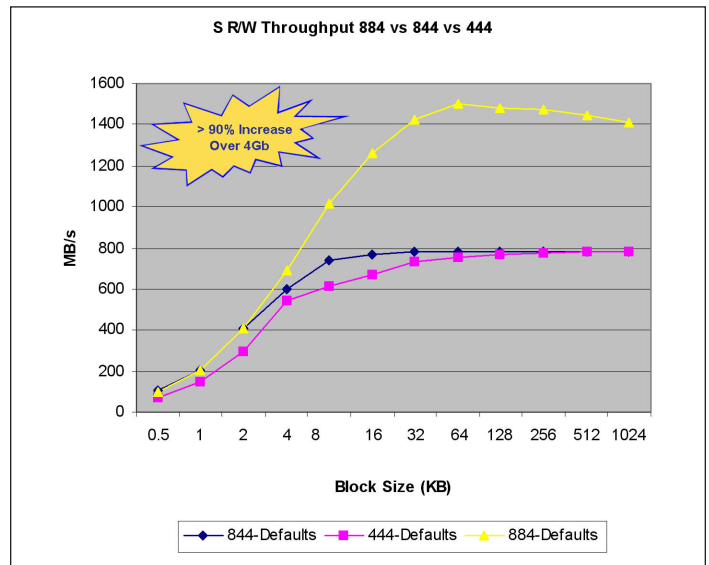
- 884 configuration: 8Gb adapter, 8Gb switch, 4Gb storage
- 844 configuration: 8Gb adapter, 4Gb switch, 4Gb storage
- 444 configuration: 4Gb adapter, 4Gb switch, 4Gb storage

The QLogic 8Gb products showed a significant performance increase over the 4Gb products, especially at smaller block sizes. Note that the QLogic 2500 series 8Gb FC adapter will be the product of choice for standard enterprise applications like Microsoft Exchange and Oracle®. These applications typically use smaller block sizes. Microsoft Exchange primarily uses 4KB data blocks for message traffic. In the testing with Oracle, 8Gb was 102 percent faster than 4Gb with data warehousing application workloads (random, large 70 percent read operations).

**In performance analysis with 8Gb, the QLogic 2500 series 8Gb FC adapter had 200,000+ IOPS and 1550 MBps for throughput on a single-port 8Gb adapter.** The highest performance measured on the 4Gb product was 150,000 IOPS and 800Mbps. The intent of this white paper (and QLogic 8Gb FC adapters) is not to end-of-life the 4Gb products, but to identify an addition to the overall QLogic FC portfolio with the introduction of the 8Gb adapter product line. QLogic 4Gb FC adapters are still the highest performing in the industry.

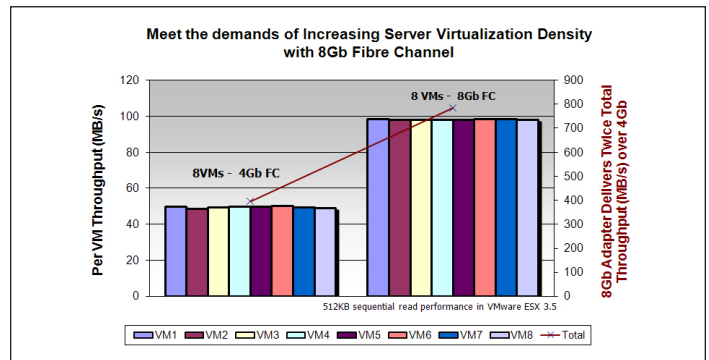
### Sequential Read/Write Throughput

At block sizes above 8KB, the QLogic 2500 series 8Gb FC adapter demonstrated a 90 percent improvement over 4Gb adapters. Applications that include D2D, MS Exchange and data replication, and remote mirroring will benefit from the QLogic 8Gb adapter.



Sequential Read/Write Throughput

QLogic 8Gb FC adapters meet the demand of increased virtual server density. With the increased throughput in the data center, the virtual server workload need is also increased. As illustrated by the following chart, there is twice the throughput in the amount of workload that can be supported with the QLogic 8Gb adapter versus the QLogic 4Gb adapter.

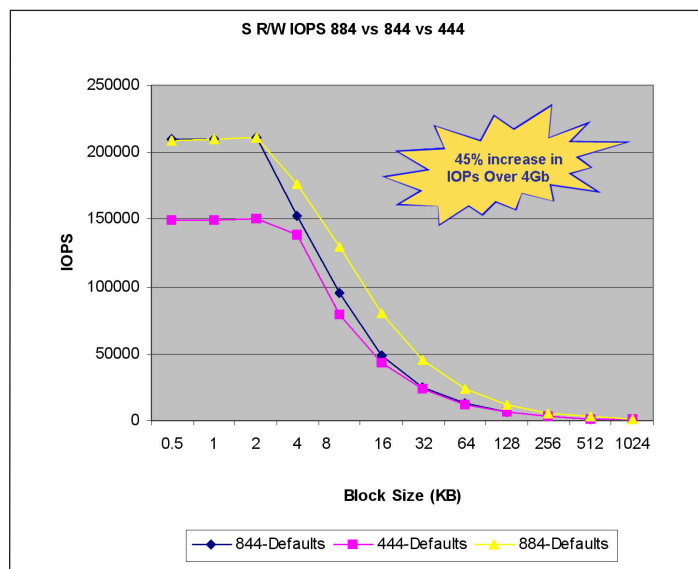


Virtual Server Workloads

To test the scalability of virtual machines, QLogic performed tests with eight virtual machines, each trying to push a throughput of 100MBps through the I/O pipe. The test results show that 8Gb adapters deliver twice the throughput as 4Gb adapters; therefore, 8Gb adapters have double the I/O scalability in virtual environments.

## Sequential Read/Write IOPS

At block sizes below 8KB, the QLogic 2500 series 8Gb FC adapter demonstrated a 45 percent improvement over 4Gb adapters. Applications that include an Oracle database and high I/O storage transactions (mirroring, snapshot, and data mining) will benefit from the QLogic 8Gb adapter.



Sequential Read/Write IOPS

## Summary and Conclusion

QLogic continues to be the industry leader in delivering high-performance I/O solutions to data center customers. The performance, IOPS, and throughput of the QLogic 2500 series 8Gb FC adapter is the best in class and provides an unprecedented level of higher performance, superior scalability, and enhanced reliability that meets and exceeds the requirements for next generation data centers.

As 2Gb and 4Gb adapters transition to 8Gb, increasing performance in SAN environments is key to supporting the infrastructure components.

The capability of scaling adequately to handle bandwidth requirements—not only on the server side but also on the storage array interface—is key to the success of next generation data centers: QLogic 8Gb FC can scale to meet these requirements. The results of this comparative study illustrate that QLogic 8Gb FC adapters can meet the IT requirements of server virtualization, lower power, and efficiency in the data center.

The changing dynamics of the data center are overwhelming, and the expectations for continuously improving efficiencies (more for less), reduced response times, and enhanced user-experience breed the deployment of “killer apps.” Infrastructure and economic dynamics drive the need for denser power optimized solutions, but increase the need for higher performance. Data center infrastructure must balance addressing these emerging challenges and protecting the current investments. While enterprises must deploy a scalable architecture to meet future challenges, they must also ensure complete backward compatibility, optimal costs, and manageability.

To summarize the key findings, the QLogic 2500 series 8Gb FC adapters demonstrate:

- **45 percent higher sequential read/write IOPS performance**
  - Greater than 50,000 IOPS higher performance over 4Gb adapters
- **100 percent higher sequential read/write throughput performance**
  - 1550 MBps, double the bandwidth of 4Gb adapters

The superior scalability advantages demonstrated in these tests deliver practical benefits in real-life applications used by enterprise IT users:

- **Lower hardware Total Cost of Ownership (TCO)**, especially with emerging cost-saving applications such as server virtualization and servers with multi-core processors. QLogic adapters provide enough IOPS and throughput to account for the high bandwidth requirements for server virtualization, D2D, and remote mirroring applications.
- **Protect your investment** by upgrading your SAN infrastructure in the data center with 8Gb QLogic adapters for higher performance and scalability, backward compatibility, and forward compatibility for next generation data centers.
- **Deliver true performance advantages** in enterprise applications such as Microsoft Exchange, Oracle, and D2D. Minimize the increase requirements of killer apps such as Web 2.0 and video on demand.

When retrieving data from a digital film library, executing large database queries (such as data mining), or for sequential processing of one or more large files, QLogic is the Fibre Channel adapter of choice. QLogic continues to demonstrate and deliver the highest performing adapter product: the QLogic 8Gb 2500 series adapter “Hauls Apps.”

## Appendix

### Server Configuration

Intel Server	
<b>Processor type and speed</b>	Intel Stoakley Dual Processor (X5355) 2.66GHz — Quad Core
<b>Memory</b>	4GB RAM
<b>OS type</b>	Windows Server® 2003 Enterprise Edition SP1
<b>Version</b>	5.x.xx.xx Service Pack 1

### FC Adapter Hardware

FC Adapters	
<b>QLogic</b>	QLE2462
<b>QLogic</b>	QLE2562

### FC Adapter Configuration

QLogic FC Adapter	
<b>8Gb QLogic driver</b>	STOR miniport
<b>8Gb driver version</b>	9.1.5.15
<b>4Gb QLogic driver</b>	STOR miniport
<b>4Gb driver version</b>	9.1.5.15

### External Storage Configuration

Storage	
<b>Solid state disk</b>	Texas Memory System RamSan solid state disk
<b>LUNs</b>	16

### FC Switch Hardware

Switch	
<b>8Gb switch</b>	QLogic 5802V
<b>4Gb switch</b>	QLogic 5602Q

### QLogic 2500 Series 8Gb FC Adapter Features, Functions, and Benefits

Higher Performance		
Feature	Function	Benefit
8Gbps FC data rate	Offers up to 1600MBps at full duplex/ port	Increases throughput to support high bandwidth applications (video, streaming, voice, and broadcast)
200,000 IOPS per port	Delivers the highest I/O transfer rates	Improves performance and response time for read and write transfers
PCI Express 2.0 (x4 and x8) host bus interface	PCI Express 2.0 enables maximum throughput of up to 4GBps (x4 Gen2)	Improves server scalability and performance

#### Disclaimer

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